

REMARKS

Favorable reconsideration is respectfully requested in view of the foregoing amendments and following remarks.

The specification has been amended to correct clerical and idiomatic errors which are self-explanatory.

Claims 1-21 have been canceled without prejudice and new claims 22-39 have been added. New claim 22 is based upon original claim 21 and is further supported in the specification at page 25, line 24 to page 26, line 4 and page 44, line 17 to page 45, line 3.

New claim 23 corresponds to original claim 2. New claim 24 corresponds to original claim 3 and includes a new limitation of the lamination speed being 100 m/minute or more, which is supported in the specification at page 26, line 4. New claims 25-36 correspond to original claims 4-15, respectively. New claims 37-39 correspond to original claims 19, 20 and 16, respectively.

Turning to the Official Action, claims 4, 16-18 and 21 were rejected under 35 U.S.C. 112, second paragraph, as being indefinite for the reasons set forth.

Claims 4 and 16 are rejected as being indefinite on the basis that it is unclear where the recited aromatic rings come from. It is respectfully submitted that the wording of the claims is clear and definite, based upon the teachings of the specification and the knowledge in the art. The claims recite that the concentration of aromatic rings in the total weight of the components (A) and (B) is 0.2 to 2.8 mmol/g. This limitation is described on page 21, lines 9-20. It is therefore respectfully submitted that the claim language is clear in specifying that the recited aromatic rings are in the components (A) and/or component (B).

Regarding the rejection of claims 17-18, these claims have been canceled and no new claims have been added corresponding to these claims.

Regarding the rejection of claim 21, this ground of rejection is deemed to be overcome by rewriting the claim in conformance with U.S. practice as new claim 22.

In view of the foregoing, it is respectfully submitted that the rejection of the former claims under 35 U.S.C. 112, second paragraph, has been overcome by the new claims presented.

Claims 1, 5-10, 13-15 and 21 were rejected under 35 U.S.C. 102 as being anticipated by Helmeke et al. Claims 2-3 and 17-20 were rejected under 35 U.S.C. 103 as being unpatentable over Helmeke et al. Claim 11 was rejected under 35 U.S.C. 103 as being unpatentable over Helmeke together with Kube. Claim 12 was rejected under 35 U.S.C. 103 as being unpatentable over Helmeke together with Werner.

These grounds of rejection are respectfully traversed as applied to the wording of the new claims.

(a) Helmeke et al. discloses “A hot melt moisture cure polyurethane composition comprising the reaction product of:

a) at least one polyether glycol formed from at least one compound selected from the group consisting of ethylene oxide, propylene oxide, 1,2-butylene oxide, 1,4-butylene oxide and mixtures thereof;

b) at least one crystalline polyester polyol having a melting point of from about 40°C. to about 120°C.; and

c) at least one polyfunctional isocyanate;

wherein the resultant one-part hot melt moisture cure polyurethane has a moisture vapor transmission rate of greater than about 500 grams per meter squared per day at a film thickness of greater than about 0.5 mils” (claim 1).

Regarding a laminate film, Helmeke et al discloses “A flexible laminate, comprising:

I. at least one flexible layer; and

II. at least one hydrophilic layer comprising a hot melt moisture cure polyurethane composition said composition comprising the reaction product of:

a) at least one polyether glycol formed from at least one compound selected from the group consisting of ethylene oxide, propylene oxide, 1, 2-butylene oxide, 1, 4-butylene oxide and mixtures thereof;

b) at least one crystalline polyester polyol having a melting point of from about 40°C. to about 120°C.; and

c) at least one polyfunctional isocyanate” (claim 15).

Further, Helmeke et al describes “there are at least two flexible layers which are adherents, and the hydrophilic hot melt moisture cure layer is an adhesive” (claim 17).

With regard to the amount of the crystalline polyester polyol, “said crystalline polyester polyol is present from about 20% to about 50% by weight of the composition” (claim 2), “the crystalline polyester polyol is useful...preferably from about 20% to about 40% by weight of the composition and most preferably from about 20% to about 30% by weight of the composition” (column 5, lines 14-18). In regard to the polyfunctional isocyanate, “An example of a useful isocyanate compound is Isocyanate® 2125M, pure diphenylmethanediisocyanate (MDI) manufactured by Dow Chemical Co. in Midland, Mich. ... Typical aromatic isocyanates include diphenylmethane diisocyanate compounds (MDI) including its isomers, carbodiimide modified MDI, ... toluene diisocyanate compounds (TDI) ... tetramethylxylene diisocyanate (TMXDI), isomers of naphthalene diisocyanate, isomers of triphenylmethane triisocyanate, and mixtures. Aliphatic di-, tri-, and polyisocyanate, hydrogenated aromatic diisocyanates, aliphatic polyisocyanates and cycloaliphatic polyisocyanates to mention only a few” (column 5, lines 29-56). In respect to the other component, “There are various other ingredients that can be added to such compositions including...adhesion promoters (i.e. silane),...deformers” (column 7, lines 60-64).

Regarding the viscosity of the composition, Helmeke et al describes “The resultant compositions are low in viscosity, having viscosities of less than about 40,000 cPs, preferably less than about 30,000 cPs and most preferably less than 20,000 cPs at 110°C. ...They also have a short set time and can form a tack-free film within 10 seconds” (column 8, lines 50-57). Further, with regard to the applicable temperature of the composition, “temperature may be varied between about 75°C and 125°C.” (column 9, lines 53-57), and the reaction is conducted at the temperature of not less than 100°C. in Examples. Furthermore, regarding the curing reaction of the composition, “When the compositions react with water, urea groups are formed to provide a polyurethane urea polymer” (column 8, lines 47-49).

Helmeke et al states “The compositions of the present invention may therefore be laminated to flexible layers including waterproof materials such as polytetrafluoroethylene,

microporous polypropylene, woven and tightly spaced nonwoven polyethylene and polypropylene, and other types of materials which are treated with hydrophobic agents” (column 9, lines 28-33). “The excellent moisture vapor transmission rates make them especially useful for adhering to, and for coating woven and nonwoven material for use in medical garments, athletic gear, rain protective garments and tarpaulins to mention only a few waterproof garments where breathability is desired” (column 3, lines 22-27).

Regarding advantages, there is described “a unique combination of polyols and isocyanates... have low viscosity, excellent thermal stability and a rapid set time as well as excellent green strength without the use of chain extender....a reactive hot melt moisture cure polyurethane composition which has a set time of less than about 10 seconds and a moisture vapor transmission rate of greater than about 500 grams/m²/day at a film thickness of greater than about 0.5 mils” (column 2, lines 48-65).

(b) Kube et al “A moisture-curing hotmelt adhesive containing:

a) polyurethane prepolymers with a content of NCO groups of 0.16 to 0.84 moles of NCO groups per kg of prepolymer formed by reaction (i) at least partly crystalline polyester polyols which are solid at room temperature and have a degree of crystallization of at least 30% and a number average molecular weight in the range from 2,000 to 10,000, optionally in admixture with liquid polyester polyols which are liquid at 20°C, and have a glass temperature below 0°C., with amorphous polyester polyols which are solid at ambient temperature and have a glass temperature above 0°C., with polyether polyols having a number average molecular of 500 to 10,000, or with mixtures of any two or more of said liquid polyester polyols, amorphous polyester polyols and polyether polyols with (ii) isocyanates; having a functionality of more than 1 which are not isocyanurates and

b) isocyanurates that are trimers of diisocyanates” (claim 1).

Kube et al describes “In another advantageous embodiment of the invention, the isocyanates having a functionality of more than 1 are selected from the group consisting of diphenylmethane-4,4'-diisocyanate, diphenylmethane-2,4'-diisocyanate, hydrogenation products of the above-mentioned diisocyanates, tolylene-2, 4-diisocyanate, tolylene-2, 6-diisocyanate,

hexamethylene diisocyanate, isophorone diisocyanate and naphthylene-1, 5-diisocyanate, including technical mixtures thereof” (column 3, lines 22-30). Kube et al mentions “The moisture-curing hotmelt adhesives according to the invention may contain typical additives familiar to one skilled in the art. Typical examples of such additives are fillers, tackifiers and plasticizers” (column 2, lines 4-7). In the Examples, the viscosity at 130°C of the adhesives are 4.73-7.35 P·s.

Kube et al states “Moisture-curing or moisture-crosslinking hotmelt adhesives based on polyurethanes are normally prepared in one step from polyols and isocyanates having a functionality of more than 1, i.e. containing more than one NCO group per isocyanate molecule, with an excess of NCO groups based on free OH groups in the polyols” (column 1, lines 26-31).

Regarding advantages, there is described “the present invention...improve the processing and performance properties of typical moisture-curing hotmelt adhesives and, more particularly, to increase the mechanical strength of the bond without any adverse effect on the viscosity of the hotmelt adhesive, its open time or its initial strength” (column 1, lines 56-61).

(c) Werner et al discloses “A moisture-curing, NCO-reactive polyurethane hotmelt adhesive composition, characterized by a reaction product obtainable by reaction of:

A) a mixture of:

i) polyfunctional polyol component which is liquid or highly viscous (paste-like) at room temperature (25°C) and which has an average molecular weight of 500 to 5,000 and which is consisting of at least one polyether and/or polyester polyol, and

ii) a polyfunctional polyol component which is crystalline at room temperature (25°C.) and which has a molecular weight of 500 to 10,000 with a mixture of

B)

i) a polyisocyanate component containing two differently reactive NCO groups and

ii) a diisocyanate component giving an NCO reactivity to hydroxyl groups which is greater than that of the less reactive NCO groups of the polyisocyanate component containing two differently reactive NCO groups,

the overall ratio of NCO:OH groups being greater than 1, and the ratio of the NCO groups of the polyisocyanate component containing two differently reactive NCO groups to the OH groups of the polyol component i) being between 1.05 and 2.0, and the ratio by weight formed from the quantity of polyol component i) plus the quantity of the polyisocyanate component containing two differently reactive NCO groups and the quantity of the crystalline polyol component ii) plus the quantity of diisocyanate component containing isocyanate groups which are more reactive to OH groups than the less reactive NCO groups of the isocyanate containing two differently reactive NCO groups being between 10 and 0.1" (claim 1).

Werner et al. describes "Moisture-curing one-component NCO-reactive polyurethane hotmelt adhesives (also known as hotmelts) are known as a basis for adhesives and sealing compounds" (column 1, lines 10-13). Examples 1 and 2, the prepolymer having a viscosity of 60,000 mPa·s at 25°C and 5,000 mPa·s at 50°C and the prepolymer having a viscosity of 21,000 mPa·s at 100°C are mixed in a ratio by weight of 1:0.5 or 1:0.4.

Werner et al describes recites "Where hotmelts are used in the automotive industry for bonding windows or headlamp lenses, i.e. glass/plastic composites, rapid curing (short cycle times), minimal shrinkage during curing and resistance to the creepage of water are particularly necessary. The imperviousness of the adhesive bond to moisture has to satisfy stringent requirements" (column 1, lines 57-63).

Regarding advantages, there is described "the problem addressed by the present invention was to develop moisture-crosslinking hotmelt adhesives which would cure flexibility with no stresses after a short setting time, could be applied with advantage to non-preheated substrates and, after curing, would give adhesive bonds highly resistant to the creepage of moisture" (column 1, line 64 to column 2, line 2).

However, the references fail to disclose a solvent-free two-component curable adhesive composition for laminating films at high-speed according to the new claims.

Helmeke et al disclose waterproof garments (such as rain gear and others) comprising the flexible laminate, however Helmeke et al fails to teach or suggest lamination of films at a high speed.

Further Helmeke et al seems to only teach a high viscous composition, since when the viscosity of less than about 40,000 cPs (=mP·s) (preferably less than about 30,000 cPs and most preferable less than 20,00 cPs) at 110°C is converted to a viscosity at 70°C, the viscosity of the composition in Helmeke et al would be remarkably increased. Please note that the viscosity of the composition in the present invention is 100 to 1,500 mPa·s at 70°C. When the composition having the high viscosity such as Helmeke et al is applied to lamination of films at a high speed, the composition cannot be coated smoothly or evenly on the surface of the film. Accordingly, the composition of Helmeke et al could not be used for lamination of films at high speed.

In addition to the high viscosity of Helmeke et al, the hot melt moisture cure polyurethane composition of Helmeke et al has a very short set time of less than about 10 seconds. That is, the coated composition is set or cured immediately. However, this short set time is incompatible to requirements for laminating films at high speed (such as developing a good external appearance after aging step), since a high speed lamination requires high leveling properties in a shorter time.

Furthermore, since the flexible laminate of Helmeke et al comprises the flexible layer and the hydrophilic layer composed of the hot melt moisture cure polyurethane composition, the hydrophilic layer absorbs moisture easily and thus delamination would occur. Namely, since the hydrophilic layer is not suitable to the lamination of films such as a plastic film or a metal foil, Helmeke et al never intend to laminate those types of films which are laminated in the present invention.

Kube et al and Werner et al fail to teach or suggest lamination of films. Further, since the adhesives of Kube et al and Warner et al are one-component curable adhesive compositions, Kube et al and Werner et al fail to disclose a two-component curable adhesive composition according to this invention.

Thus, the use of the solvent-free two-component curable adhesive composition for laminating films could not be suggested by the references.

Moreover, the present invention provides unexpected advantages. That is, the references require moisture essentially for curing the hot melt moisture cure polyurethane composition, as is apparent from the cure mechanism, and therefore the cured product produces an urea group or

bond. Further, please note that the polyurethane composition of Helmeke et al has a high moisture vapor transmission rates. Thus the polyurethane composition is used for an application required to improve moisture vapor transmission rates by contacting with moisture.

Furthermore, as above-mentioned, since the composition of Helmeke et al has high viscosity, the high speed lamination of films with the composition would be difficult. Since the adhesives of Kube et al and Werner et al are one-component curable adhesive compositions, the adhesives have high viscosity and thus high speed lamination would be difficult. Furthermore, since the composition of Helmeke et al has a shorter set time, when the composition of Helmeke et al is applied to lamination at a high speed, small dots at the time immediately after lamination are not disappeared or leveled by aging step, and thus the external appearance of the laminated film is adversely affected. That is, since the composition of Helmeke et al does not have high flowability and has the short set time, high leveling properties could not be realized by the composition. On the other hand, according to the present invention, since the specific solvent-free two-component curable adhesive composition is used for laminating films at a high speed, moisture is not essential to the cure mechanism and the isocyanate group is reacted with the hydroxyl group of the polyols effectively. Thus, the cured product produces an urethane group or bond. Further, according to the present invention, since the present composition has low viscosity, the composition is suitable to laminating films at high speed. In particular, even when laminating at a high speed with the present composition, since the composition has a low viscosity immediately after 10 minutes from mixing the components, the laminated film has the good external appearance at the time both immediately after lamination and after aging step as apparent from Examples 1-11 on Tables 1 and 2 of the present description. That is, since the present composition has high flowability and thus is applied uniformly on the surface of the film, the composition has high leveling properties.

The advantages in laminating films at a high speed by the present invention could never be predicted from or suggested by the references.

Therefore, it is respectfully submitted that the present invention is novel and nonobvious from the cited references.

In view of the foregoing, favorable reconsideration and allowance is respectfully solicited.

Respectfully submitted,

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Akihiro IMAI et al.

By: Warren M. Cheek, Jr.
Warren M. Cheek, Jr.
Registration No. 33,367
Attorney for Applicants

WMC/kes
Washington, D.C. 20006-1021
Telephone (202) 721-8200
Facsimile (202) 721-8250
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